

## MIRROR Investigation

Exploring reflections from different types of mirrors.

**Grade(s):** ES and MS

**Topic:** Physical Science

**Standards:**

**Disciplinary Core Ideas:**

PS4.B Electromagnetic Radiation

Crosscutting Concepts:

Cause and Effect

Patterns

Structure and Function

**Science and Engineering Practices:**

Constructing Explanations and Designing Solutions

Scientific Knowledge is Based on Empirical Evidence

Obtaining, Evaluating and Communicating Information

Performance Expectations: Waves and Their Applications in Technologies for Information Transfer (PS4)

1-PS4-3

MS-PS4-2

**Objective:**

Students will demonstrate understanding of the phenomena of different types of mirrors and apply the findings to everyday life.

**Materials:**

Acrylic mirrors with first surface and second surface

Small dry erase markers

Dry erase posters cut in 4 x 4 inches

Concave mirrors (soup spoon or ladle)

Cylindrical mirrors (mirror wall paper on PVC)

### **Activity 1**

Have students spend 5-10 minutes exploring the flat mirror.

Listen to the types of statements or questions they have.

Have students share their observations.

Use information from the students to ask questions for them to explore with the mirror. Where have they used this type of mirror in their life?

Ask them to figure out:

How do

- mirrors reflect light
- is an image created
- compare to the size of object to the size of the image

Offer pens and an index card to model or draw their explanation.

Hand out white board markers for further exploration.

Marking a dot on each side of the mirror.

Notice the differences.

The side that has only one reflection of the dot is called the first surface or front surface mirror. The other side should have 2 dots.

Light passes through the Plexiglas and reflects off the back side of the mirror.

### **Activity 2 (ladle/ soup spoon)**

Hand out spoon have students explore.

The same questions above can be used again.

What do you notice about your image? Use your finger and try to find the image of your finger

Ask students if they have seen mirrors in their experience that are curved like the curved mirror. If so, what were they used for?

All spoons will reflect the same. If the spoon is curved inward or concave the light comes together (converge) and the image is upside down. When you move the mirror away the image gets smaller and is right side up and is magnified.

Flip the spoon over and look at your image again. This is a convex mirror and the light spreads apart (diverge) and the image is smaller and you can.

Move the spoon away and you see more things behind you.

### Activity 3

Hand out the Flexible mirror.

Have students explore on their own.

Things to try:

- distort your face
- make your nose wider
- make your nose longer
- make as many images of your eyes as possible
- make your image skinny

The flexible mirror allows you to change the direction that the light reflects off the mirror and into your eyes.

When the mirror is flat, the light reflects off the mirror at the same angle as when it hit the mirror.

When the mirror is curved the light goes in a different direction depending on how it is curved.

### What about mirrors?

Mirrors obey one main rule: The angle of incidence, at which light hits the mirror, equals the angle of reflection, at which light bounces off the mirror. Dividing these angles, perpendicular to the mirror, is the “normal” line- all angles are measured from the normal.

Flat mirror – light bounces straight to your eye, the angle of incidence is zero.

Convex mirror- light bounces down to your eye, making the image shorter.

Concave mirror – light bounces up to your eye, making the image taller

### Resources:

1. Flat front/first surface mirror

Discount School Supply

SCI HOS MIR 05 – Handheld Acrylic Mirrors –set of 12

2. Serving ladles or spoons

Dollar Tree

3. Mirror wallpaper

[https://www.amazon.com/d-c-fix-Self-Adhesive-Mirror-17-71-215-0005/dp/B009S55WHE/ref=sr\\_1\\_2?s=home-garden&ie=UTF8&qid=1520364019&sr=1-2&keywords=mirror+wallpaper](https://www.amazon.com/d-c-fix-Self-Adhesive-Mirror-17-71-215-0005/dp/B009S55WHE/ref=sr_1_2?s=home-garden&ie=UTF8&qid=1520364019&sr=1-2&keywords=mirror+wallpaper)

4. PVC pipe 1 ¼ inch schedule 20  
Lowe's or Home Depot
5. Anamorphic Art- Mirror Distortion. Directions on making anamorphic art.  
<https://anamorphicart.wordpress.com/2010/04/21/cylindrical-mirror-anamorphoses/>
6. Mirror Science: Flexible Mirror Lab  
<https://aapt.org/K12/upload/8-Flexible-Mirror-Science-WIP-1.docx>
7. Dry erase posters cut 4 x 4 inches (32)

**LIGO Connection:**

LIGO mirrors are slightly concave. However, these mirrors don't look like the everyday mirror or the mirrors we are exploring with today. LIGO's mirrors are made of beautifully polished glass and are called optics, each one is 40 kg or ~90 lbs. These mirrors are suspended inside vacuum chambers and reflect the infrared laser used in the interferometer.

These mirrors have different reflective properties depending on location. Parts of the mirrors may be highly reflective and other parts anti-reflective.